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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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10/659,778

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Edward P. Barth

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International Business Machines Corporation  
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EXAMINER

NOVACEK, CHRISTY L

ART UNIT

PAPER NUMBER

2822

DATE MAILED: 03/29/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

**Office Action Summary**

Application No.

10/659,778

Applicant(s)

BARTH ET AL.

Examiner

Christy L. Novacek

Art Unit

2822

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

- 1) ☒ Responsive to communication(s) filed on 10 September 2003.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

- 4) ☒ Claim(s) 1-24,26,27 and 29 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1-24,26,27 and 29 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

**Application Papers**

- 9) ☒ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 10 September 2003 is/are: a) ☐ accepted or b) ☒ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

**Priority under 35 U.S.C. §§ 119 and 120**

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some \* c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
  2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
  3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- \* See the attached detailed Office action for a list of the certified copies not received.
- 13) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application) since a specific reference was included in the first sentence of the specification or in an Application Data Sheet. 37 CFR 1.78.
- a) ☐ The translation of the foreign language provisional application has been received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121 since a specific reference was included in the first sentence of the specification or in an Application Data Sheet. 37 CFR 1.78.

**Attachment(s)**

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) \_\_\_\_\_.
- 4) ☐ Interview Summary (PTO-413) Paper No(s). \_\_\_\_\_.
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: \_\_\_\_\_.

### **DETAILED ACTION**

This Office Action is in response to the preliminary amendment filed November 10, 2003.

#### ***Priority***

Applicant has not complied with one or more conditions for receiving the benefit of an earlier filing date under 35 U.S.C. 120 as follows:

An application in which the benefits of an earlier application are desired must contain a specific reference to the prior application(s) in the first sentence of the specification of in an application data sheet (37 CFR 1.78(a)(2) and (a)(5)). The specific reference to any prior nonprovisional application must include the relationship (i.e., continuation, divisional, or continuation-in-part) between the applications except when the reference is to a prior application of a CPA assigned the same application number.

The remarks filed September 10, 2003 states that "Applicant's have previously presented documentation claiming priority to SN 08/744,846". As such, the declaration filed September 10, 2003 is defective because it states that the current application does not claim priority to any previous application under 35 U.S.C. Section 120 (see page 2 of the declaration). Therefore, a new oath or declaration in compliance with 37 CFR 1.67(a) identifying this application by application number and filing date is required. See MPEP §§ 602.01 and 602.02.

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#### ***Drawings***

Figure 1 should be designated by a legend such as --Prior Art-- because only that which is old is illustrated. See MPEP § 608.02(g).

Art Unit: 2822

The drawings are objected to as failing to comply with 37 CFR 1.84(p)(5) because they include the following reference sign(s) not mentioned in the description: “5” (Fig. 1). A proposed drawing correction, corrected drawings, or amendment to the specification to add the reference sign(s) in the description, are required in reply to the Office action to avoid abandonment of the application. The objection to the drawings will not be held in abeyance.

The drawings are objected to under 37 CFR 1.83(a). The drawings must show every feature of the invention specified in the claims. Therefore, the following features (a, b and c) must be shown or the feature(s) canceled from the claim(s). No new matter should be entered.

a) the capping layer formed on the fluorine containing layer as disclosed in lines 2-3 of claim 2

b) the substrate as disclosed in lines 2 and 4 of claim 1, line 2 of claim 5, lines 2, 4 and 10 of claim 9

c) the “substrate having metal structures therein” as disclosed in lines 2 and 3 of claim 20

A proposed drawing correction or corrected drawings are required in reply to the Office action to avoid **abandonment** of the application. The objection to the drawings will **not** be held in abeyance.

### *Specification*

The disclosure is objected to because of the following informalities:

On page 9, ln. 23, “intention” should be “intentional”.

On page 10, ln. 6-7, the sentence beginning “In a preferred” does not make grammatical sense.

Art Unit: 2822

On page 11, ln. 14-15 and 17, “0.6  $\mu$ ”, “0.4  $\mu$ ” and “0.53  $\mu$ ” should be corrected to read “0.6  $\mu\text{m}$ ”, “0.4  $\mu\text{m}$ ” and “0.53  $\mu\text{m}$ ”, respectively.

On page 11, ln. 16, “0.4 um” should be corrected to read “0.4  $\mu\text{m}$ ”.

The specification is objected to as failing to provide proper antecedent basis for the claimed subject matter. See 37 CFR 1.75(d)(1) and MPEP § 608.01(o). Correction of the following is required:

The specification does not disclose forming a capping layer on the fluorine containing insulating layer as is stated in claim 2. The specification only discloses forming the capping layer between the USG and FSG layers or at the bottom of a wire trench, (pg. 8, ln. 12-14).

The limitation of “or combinations thereof” as stated in claim 6, line 4 is not disclosed by the specification (pg. 10, ln. 20-22).

### ***Claim Objections***

Claims 4, 5, 7, 20 and 23 are objected to because of the following informalities:

In line 2 of claim 5, the word “prior” after the word “formed” should be deleted in order for the claim to make grammatical sense.

In line 9 of claim 20, “the substantially planar substrate” lacks antecedent basis. The amendment filed September 10, 2003 deleted the words “substantially planar” from line 2 of the claim.

In line 2 of claim 4, 7 and 23, the limitation “the substantially free insulating layer” does not make sense. The word “fluorine” should be inserted between “substantially” and “free”.

Applicant is advised that should claim 22 be found allowable, claim 26 will be objected to under 37 CFR 1.75 as being a substantial duplicate thereof. When two claims in an application are duplicates or else are so close in content that they both cover the same thing, despite a slight difference in wording, it is proper after allowing one claim to object to the other as being a substantial duplicate of the allowed claim. See MPEP § 706.03(k).

Appropriate correction is required.

***Claim Rejections - 35 USC § 112***

The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

Claims 17-24, 26, 27 and 29 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

Line 2 of claim 17 recites the limitation of “patterning the layer”. However, claim 16, upon which claim 17 depends, recites two different layers, a “substantially fluorine-free insulating layer” and a “fluorine containing insulating layer”. Therefore, it is unclear as to which “layer”, the limitation in claim 17 is referring.

Lines 8 and 9 of claim 20 recite the limitation of “the metal structure”. However, it is unclear as to what “the metal structure” is referring, as “metal structures” were recited in line 3 of the claim and a different “metal structure” was recited in line 8 of the claim. Additionally, claims 27 and 29 also recite the limitation of “the metal structure” and it is unclear as to which “metal structure” in claim 20 these claims are referring.

***Claim Rejections - 35 USC § 102***

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

Claims 1-5 and 7-17 are rejected under 35 U.S.C. 102(b) as being anticipated by Nishiyama et al. (US 5,429,995, cited in parent application).

Regarding claims 1 and 16, Nishiyama discloses a substrate (81), depositing a substantially fluorine free insulating layer (84) on the substrate, having a height, and depositing a fluorine containing insulating layer (85) on the fluorine free insulating layer, also having a height (Fig. 8D, col. 7, ln. 61-62; col. 7, ln. 65-66).

Regarding claim 2, Nishiyama discloses forming a capping layer (86) on the fluorine containing insulating layer (Fig. 8D, col. 7, ln. 68-col. 8, ln. 2).

Regarding claims 3 and 8, Nishiyama discloses that the fluorine containing insulating layer is made of fluorinated silicon oxide (col. 7, ln. 65-67).

Regarding claims 4 and 7, Nishiyama discloses that the substantially fluorine free insulating layer is made of undoped silicon glass (silicon dioxide) (col. 7, ln. 61-64).

Regarding claim 5, Nishiyama discloses forming a capping layer (82) on the substrate prior to the formation of the substantially fluorine free insulating layer (Fig. 8D, col. 7, ln. 56-58).

Regarding claim 9, Nishiyama discloses a substrate (81), a substantially fluorine free insulating layer (84) on the substrate, having a height, and a fluorine containing insulating layer (85) on the fluorine free insulating layer, also having a height. A patterned metal structure (83,

Art Unit: 2822

88, 89) has sidewalls in contact with the substantially fluorine free insulating layer and the fluorine containing insulating layer and the bottom of the metal structure is in contact with the substrate (Fig. 8D and col. 8, ln. 8-12).

Regarding claim 10, Nishiyama discloses the metal structure to have at least two portions (83, 88, 89), each portion having a height (Fig. 8D).

Regarding claim 11, Nishiyama discloses that the height of one of the metal portions (83, 88, 89) is greater than the height of the substantially fluorine free layer (col. 7, ln. 58-62).

Regarding claims 12 and 13, Nishiyama discloses that the height of one of the metal portions (83, 89) is less than the height of the fluorine containing layer (col. 7, ln. 65-66).

Regarding claim 14, Nishiyama discloses that the metal portion with a height less than that of the fluorine containing layer is a line (col. 7, ln. 58-59; col. 8, ln. 11-12).

Regarding claim 15, Nishiyama discloses that the metal portion with a height greater than that of the substantially fluorine free layer is a via (Fig. 8D).

Regarding claim 17, Nishiyama discloses patterning the layer and depositing a metal (83/88/89).

Claims 1-10, 16-18, 20-24, 26, 27 and 29 are rejected under 35 U.S.C. 102(e) as being anticipated by Kudo (US 6,420,261, cited in parent application).

Regarding claims 1, 9, 16, and 20, Kudo discloses a substantially planar substrate (24/23/22/21), having underlying metal structures (29) therein, a substantially fluorine free insulating layer (silicon dioxide) (31) on the substrate, having a height, and a fluorine containing insulating layer (32) on the fluorine free insulating layer, also having a height (Fig. 3F; col. 7, ln. 5-16; col. 5, ln. 61-col. 6, ln. 13). A metal feature (39/40/41/42) of at least the combined height

Art Unit: 2822

of the fluorine free layer (31) and the fluorine-containing layer (32), is formed in layers 31 and 32 and extends to, and is in contact with, the substrate (24/23/22/21) (Fig. 3O-3P; col. 8, ln. 26-41).

Regarding claim 2, Kudo discloses a capping layer (33) formed on the fluorine containing insulating layer.

Regarding claims 3, 8, 22 and 26, Kudo discloses that the fluorine containing insulating layer (32) is made of fluorinated organic polymer (col. 6, ln. 1-13).

Regarding claims 4, 7 and 23, Kudo discloses that the substantially fluorine free insulating layer (31) is made of undoped silicon glass (silicon dioxide) (col. 7, ln. 9-10).

Regarding claims 5 and 21, Kudo discloses a capping layer (30) on the substrate (24/23/22/21) underlying the substantially fluorine free insulating layer (31) (Fig. 3Fcol. 7, ln. 8-11).

Regarding claims 6 and 24, Kudo discloses that the capping layer (30) is made of silicon nitride (col. 7, ln. 8-9).

Regarding claim 10, Kudo discloses that the patterned metal structure has at least two portions (trench and via), each of which has a height.

Regarding claim 17, Kudo discloses patterning the fluorine free and fluorine containing insulator layers and depositing a metal (39/40/41/42).

Regarding claim 18, Kudo discloses that the patterning (opening) has at least two portions (trench and via) and each portion has a height.

Regarding claim 27, Kudo discloses that the metal structure extends through the capping layer and has a height greater than the height of the substantially fluorine free insulating layer plus the height of the fluorine containing insulating layer (Fig. 3O).

Regarding claim 29, Kudo discloses that the metal structure is in contact with the underlying metal structures through the capping layer (Fig. 3O).

Claims 1, 5-9, 16, 17, 20-24, 26, 27 and 29 are rejected under 35 U.S.C. 102(e) as being anticipated by Anand et al. (US 6,307,265).

Regarding claims 1 and 16, Anand discloses a substrate (21/22/23/24/25/26/27/28/39), depositing a substantially fluorine free insulating layer (30) on the substrate, having a height, and depositing a fluorine containing insulating layer (32) on the fluorine free insulating layer, also having a height (Fig. 8-19; col. 19, ln. 66 – col. 21, ln. 13).

Regarding claims 5 and 21, Anand discloses forming a capping layer (29) on the substrate prior to the formation of the substantially fluorine free insulating layer (Fig. 10).

Regarding claims 6 and 24, Anand discloses that the capping layer is made of silicon nitride (col. 19, ln. 66-67).

Regarding claims 7 and 23, Anand discloses that the substantially fluorine free insulating layer is made of undoped silicon glass (silicon dioxide) (col. 20, ln. 47-49).

Regarding claims 8, 22 and 26, Anand discloses that the fluorine containing insulating layer is made of fluorinated silicon oxide (fluorinated TEOS) (col. 21, ln. 11-13).

Regarding claim 9, Anand discloses a substrate (21/22/23/24/25/26/27/28/39), a substantially fluorine free insulating layer (30) on the substrate, having a height, and a fluorine containing insulating layer (32) on the fluorine free insulating layer, also having a height. A patterned metal structure (33a/33b) has sidewalls in contact with the substantially fluorine free insulating layer and the fluorine containing insulating layer and the bottom of the metal structure is in contact with the substrate (Fig. 8-21; col. 19, ln. 66 – col. 21, ln. 20).

Art Unit: 2822

Regarding claim 17, Anand discloses patterning the fluorine free and fluorine containing insulator layers and depositing a metal (33a/33b).

Regarding claim 20, Anand discloses a substantially planar substrate (21/22/23/24/25/26/27/28/39), having underlying metal structures (28a/28b) therein, a substantially fluorine free insulating layer (30) on the substrate, having a height, and a fluorine containing insulating layer (32) on the fluorine free insulating layer, also having a height (Fig. 8-19; col. 19, ln. 66 – col. 21, ln. 20). A metal feature (33a/33b/35a/35b) of at least the combined height of the fluorine free layer (30) and the fluorine-containing layer (32), is formed in layers 30 and 32 and extends to the substrate (Fig. 22; col. 21, ln. 14-20).

Regarding claim 27, Anand discloses that the metal structure (33a/33b/35a/35b) extends through the capping layer such that the height of the structure is greater than the height of the fluorine free and fluorine containing layers.

Regarding claim 29, Anand discloses that the metal structure is in contact with the underlying metal structures through the capping layer (Fig. 21).

Claims 1-19 are rejected under 35 U.S.C. 102(e) as being anticipated by Venkatesan et al. (US 6,326,301).

Regarding claims 1 and 16, Venkatesan discloses a substrate (12/14a/14b), depositing a substantially fluorine free insulating layer (18) on the substrate, having a height (8000 Å), and depositing a fluorine containing insulating layer (22) on the fluorine free insulating layer, also having a height (4000-5000 Å) (Fig. 1 and 2; col. 5, ln. 55 – col. 8, ln. 35).

Regarding claim 2, Venkatesan discloses a capping layer (23) formed on the fluorine containing insulating layer (Fig. 9).

Art Unit: 2822

Regarding claims 3, 8, 22 and 26, Venkatesan discloses that the fluorine containing insulating layer is made of fluorinated silicon oxide (fluorine-doped TEOS) (col. 5, ln. 55-62).

Regarding claims 4, 7 and 23, Venkatesan discloses that the substantially fluorine free insulating layer is made of undoped TEOS (silicon glass) (col. 5, ln. 55-62).

Regarding claims 5 and 21, Venkatesan discloses forming a capping layer (16) on the substrate prior to the formation of the substantially fluorine free insulating layer (Fig. 1 and 2).

Regarding claims 6 and 24, Venkatesan discloses that the capping layer is made of silicon nitride (col. 6, ln. 30-32).

Regarding claim 9, Venkatesan discloses a substrate (12/14a/14b), a substantially fluorine free insulating layer (18) on the substrate, having a height, and a fluorine containing insulating layer (22) on the fluorine free insulating layer, also having a height. A patterned metal structure (32/34/36) has sidewalls in contact with the substantially fluorine free insulating layer and the fluorine containing insulating layer and the bottom of the metal structure is in contact with the substrate (Fig. 4 and 9; col. 5, ln. 55 – col. 8, ln. 35).

Regarding claim 10, Venkatesan discloses that the patterned metal structure has at least two portions (line and via) with each portion having a height (Fig. 4 and 9).

Regarding claim 11, Venkatesan discloses that the height of the via is greater than the height of the substantially fluorine free layer (Fig. 9).

Regarding claims 12 and 13, Venkatesan discloses that the height of the line is less than the height of the fluorine of the fluorine containing layer (Fig. 9).

Regarding claim 14, Venkatesan discloses that the portion of the metal structure having a height less than the height of the fluorine containing layer is a line (Fig. 9).

Regarding claim 15, Venkatesan discloses that the portion of the metal structure having a height less than the height of the fluorine free insulating layer is a via (Fig. 9).

Regarding claim 17, Venkatesan discloses patterning the fluorine free and fluorine containing insulating layers and depositing a metal (32/34/36) (Fig. 9).

Regarding claim 18, Venkatesan discloses that the patterning (opening) has at least two portions (a line and a via), each portion having a height (Fig. 8 and 9).

Regarding claim 19, Venkatesan discloses that the height of the via opening is greater than the height of the substantially fluorine free layer and the height of the line opening is less than the height of the fluorine of the fluorine containing layer (Fig. 9).

Regarding claim 20, Venkatesan discloses a substantially planar substrate (12/14a/14b), having underlying metal structures (14a/14b) therein, a substantially fluorine free insulating layer (18) on the substrate, having a height, and a fluorine containing insulating layer (22) on the fluorine free insulating layer, also having a height (Fig. 1 and 2; col. 5, ln. 55 – col. 8, ln. 35). A metal feature (32/34/36) of at least the combined height of the fluorine free layer and the fluorine-containing layer, is formed in layers 18 and 22 and extends to the substrate (Fig. 4; col. 5, ln. 55 – col. 8, ln. 35).

Regarding claim 27, Venkatesan discloses that the metal structure extends through the capping layer such that the height of the structure is greater than the heights of the fluorine free and fluorine containing insulating layers (Fig. 4 and 9).

Regarding claim 29, Venkatesan discloses that the metal structure is in contact with the underlying metal structures through the capping layer (Fig. 4 and 9).

### ***Conclusion***


Art Unit: 2822

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Christy L. Novacek whose telephone number is (571) 272-1839. The examiner can normally be reached on Monday-Thursday and alternate Fridays 7:30 - 5:00.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Amir Zarabian can be reached on (571) 272-1852. The fax phone number for the organization where this application or proceeding is assigned is (703) 872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

CLN  
March 21, 2004

  
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SUPERVISOR, EXAMINER  
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